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NOTES ON THE LEAF-CUTTER BEE MEGACHILE
(EUTRICHARAEA) GRATIOSA GERSTAECKER

(Hymenoptera: Megachilidae)

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Four species of small solitary bees have occupied artificial nest sites at Port Elizabeth. The leaf-cutter, *Megachile (Eutricharaea) gratiosa* Gerstaecker and the megachilid *Heriades freygessneri* Schletterer, have been the most numerous inhabitants. The latter species is the subject of another paper now in press.

The artificial nests have been described elsewhere, and it is sufficient to mention here that *M. gratiosa* readily used glass vials or tubes of two sizes, three inches by three-tenths of an inch and one inch by one-fifth of an inch respectively. It was found, however, that nests in glass vials tended to become mouldy through the "sweating" of the leaf fragments used in nest construction. Although some bees were successfully reared in them, many died in the developmental stages. The fact that the larger tubes were open at both ends did not seem to help. Paper cylinders of the same dimensions were substituted for the larger vials and these have been most successful. Unfortunately, however, it was impossible to observe progress in the paper cylinders. Rearing tubes made of cellophane and liberally punctured with pin holes were an improvement in this respect, but the cellophane was found to be somewhat flimsy. Cylinders made of celluloid are now being used with fair success. In a recent paper Stephen (1961) describes how milk straws were used for the mass production of *Megachile (Eutricharaea) rotundata* (Fabricius) in the Pacific Northwest, and it is intended to experiment here with the transparent type of straw if and when available.

It may here be mentioned that the cylinders containing the nests are inserted in holes in small blocks of wood which are situated out-of-doors on a north-facing window sill. This constitutes the nest site. On completion the nests are removed indoors and kept at room temperature until emergence. During summer the room temperature varies from 82°F to 64° F, the daily average being 72.8°F. In autumn and winter it varies from 70°F to 50° F, the average being 60°F.

M. gratiosa is active at Port Elizabeth from spring to late summer and autumn. In 1959, it was first noted at the nest site on 11 September, in 1960 on 15 September, and in 1961 on 5 September. In 1960, it remained present until the beginning of May, but in 1961 it was not seen after 27 March. In 1962, it was last seen at the nest site on 6 April, and it reappeared again there on 13 August. While activity at the site continues throughout, it is more marked in late spring and again late in the summer.

Nest construction commences as soon as the bees appear at the site, and continues, more or less, until they are last noted there in autumn. They are, of course, more active in warm weather; under cold and wet conditions they remain dormant in their partially constructed nests. The number of cells per nest varies: up to nine have been found in the large vials and cylinders, although eight is the more usual maximum, while the small vials can take only four cells at the most. Nests often consist of fewer cells and sometimes of one cell only.

The time occupied in the construction of a nest also varies greatly and depends largely upon the climatic conditions prevailing at the time. In fine and warm weather, construction is much more rapid. Thus, under such conditions, a nest of eight cells has been completed in five days, while in less favourable weather a nest of this size has taken twenty days to construct. In one case it took eight days to complete two cells, and in another seven days were occupied in the construction of one cell. Building at the rate of one cell per day would appear to be the average.

The structure of the cells of leaf-cutter bees is too well-known to require description here: suffice it to say that the cells and nest of *M. gratiosa* are typical, *i.e.* long, elliptical leaf portions for the sides of the cells and round portions for the ends. Green leaves are generally used but sometimes colored, modified leaves are used as well as flower petals. The longer elliptical sections may measure up

to 6×4 mm in length. When the last cell of a nest has been completed the entrance is plugged with a thick wad consisting of round sections of leaf. This wad, which may be anything up to 20 mm in length, often protrudes outwards, with a longer and loose piece of leaf extending further. In the larger vials there is sometimes an empty space of varying length between the last cell and the entrance plug. Occasionally a vial may be partially or even entirely filled with plug material with few or no cells. Perhaps even leaf-cutter bees have their frustrations.

M. gratiosa is more active on the wing than *Heriades*, flying around to a greater extent and making a high humming sound in flight. In the emergence vials they betray their arrival with loud humming, whereas *Heriades* is silent. While prospecting for nest sites they repeatedly enter holes, removing fragments or splinters of wood, etc., in their way. Sometimes one will enter a vial already occupied by *Heriades*, but it is soon forcibly ejected. One individual, which already had a nest, was seen endeavouring to pull, head first, another female out of her nest. The intruder soon desisted and returned to its own abode. Sometimes, on returning to the nest site, leaf-cutter bees settle on the wooden block containing the vials or elsewhere in the vicinity before entering their nests, but they are not so persistent in this custom as *Heriades*.

While engaged upon nest construction the bees are constantly going and coming, taking less than a minute to fetch their portions of leaf. They may remain in the vials for about one minute or longer and during this time they often come out and back in again rapidly. The same procedure takes place when collecting nectar or pollen but periods of absence may then extend up to ten minutes. Soon after entering they come out to reverse in again, the time spent within once more occupying about one minute. On several occasions, a bee, when disturbed, dropped a piece of leaf just as it was about to enter its nest. It hovered around for a few seconds and then left to fetch another piece without attempting to recover the dropped portion. The latter was then placed in the entrance to the nest, but it was immediately thrown out by the bee when it returned with a fresh piece.

Newly constructed cells contain a dark orange liquid, somewhat granulated and sweet, which leaves a yellow stain when dry. Immersed in this is a more solid, dough-like bee bread formed from a pollen believed to be derived from composite flowers. In this con-

nection, Stephen (*op. cit.*) states that *Megachile (Eutricharaea) rotundata* is oligolectic to alfalfa (lucerne) in the Pacific Northwest. For this reason it was being mass-reared to assist the pollinating of the crop for increased seed production.

The cylindrical and hyaline egg, measuring some 2 mm in length, is deposited on its side upon the accumulated food in the cell and in a more or less vertical position.

The period occupied by the immature stages of *M. gratiosa* varies considerably with the time of year. Nests formed from late February, and sometimes even earlier, do not produce adult progeny until the following December, and emergences from nests formed in the spring commence at about the same time. In 1960, adults emerged from nests formed in the spring before those from nests constructed in the previous autumn. The origin of the spring individuals seen at the nest site from August to November, remains unknown. No emergence from nests formed in the autumn of the previous season has taken place before December. The species disappear from the nest site in autumn and have not been seen there again until early spring.

The shortest period from the completion of a nest to emergence was 24 days, but this was quite exceptional. For spring and summer nests the more general duration of the combined developmental stages varied from 36 to 72 days. The nests formed in late summer and autumn have occupied from 261 to 306 days, but an extreme instance of 330 days was also obtained. This was from a nest completed on 28 January 1961, and from which numerous individuals of a chalcid parasite emerged from 17 March to 24 April. Unexpectedly, two bees emerged from this nest on 23 and 28 December. From the commencement of nest construction to first emergence the periods are naturally somewhat longer.

Sometimes all the bees emerge from a nest on the same day, but more generally over a period of a few days. In *Heriades* a greater time lag exists between each emergence from one nest. However, emergence in the case of *M. gratiosa* may also be protracted, and three extreme periods of 12, 15 and 23 days were recently obtained, but these are exceptional. Otherwise the emergence period has varied from 1 to 8 days with an average of 4.3 days in 1961/62. In most, but not all, cases the males emerge before the females. In 15 out of 17 nests the males emerged first, and in the remaining two (while males were the first to emerge) other males emerged

later, after several females had done so. In one case a male was the last of seven bees of both sexes to emerge. Occasionally all the progeny of one nest are of the same sex, but a mixture of both sexes is much more usual. From 29 nests a total of 164 adult bees were obtained, of which 91 (55.5%) were males.

The adult bee is stout, between 7 and 8 mm in length. The female is well-covered with silvery grey hairs, which are darker on the upper part of the face and head. The abdomen is black and ringed with short silver hairs, giving a banded appearance. The tip of the abdomen is pointed and the scopa or pollen brushes are deep orange. The female can be safely handled and is reluctant to sting although capable of doing so. If pressed gently between one's fingers, it first uses its mandibles which can inflict faint nips. It will eventually use its sting, but the effect is only momentary. The sting does not seem to be sufficiently powerful to pierce the human skin easily.

In the male bee the tip of the abdomen is blunt, and the hairs, including the abdominal rings, are yellowish-buff. The male has not been seen at the nest site or in the vials except at the time of emergence.

NATURAL ENEMIES

Two individuals of *Miltogramma* sp. (Sarcophagidae) emerged from a five-celled nest which was formed between 6 and 13 March, 1960. The first fly emerged on 7 April, and the second not until 1 November, while two bees emerged from the same nest on 12 and 13 December. A much more numerous parasite is a minute chalcid which first made its appearance during the late summer of 1961. This parasite has been determined, from the female sex only, as *Melittobia* sp. probably *hawaiiensis* Perkins (Eulophidae). From a nest completed at the beginning of January, this chalcid commenced to emerge on 6 February and continued to do so in numbers until 25 February, while one bee emerged on 8 February. On 10 March, the nest was removed from its paper cylinder and examined. Two cells were found to contain the desiccated remains of adult bees, while the three first or basal cells had a few minute holes in the sides, lids and/or bases. These three cells were empty save for fragments of pollen and thin and flaky semi-transparent material, apparently the skins of chalcid pupae. Another nest from which parasites had emerged between 4 and 8 March, 1961, was also opened. One cell contained parts of the head and abdomen of

a bee as well as parasites in various stages of pupal and adult development. Other parasitized nests were subsequently found. In 1961/62, from a nest formed in November the chalcid parasite has been emerging since 23 January.

More recently a metallic green ruby wasp *Chrysis (Tetrachrysis) laetabilis* Buysson (Chrysididae) has been obtained from nests of *M. gratiosa*. One individual emerged from an overwintering nest, and three emerged in late January from a nest formed in November. This chrysidid is widely distributed in South Africa, and has also been obtained from the nests of *Heriades freygessneri*.

H. freygessneri sometimes occupied a vial which already had one or more completed or abandoned cells of *M. gratiosa*. In such cases, most or all of the original nest or partial nest, as the case may be, is removed by the new occupant, although one of the emptied cells is often used as a foundation for the new nest. Very occasionally an adult *M. gratiosa* may emerge from one of these commandeered nests.

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REFERENCE

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MEETING NOTICE

The 47th Annual meeting of the Pacific Branch of the Entomological Society of America will be held at the Gearhart Hotel, Gearhart, Oregon on June 24 through 27. Among the sixty papers to be presented, five will be included in a symposium entitled, "Recent advances in research on the relationship of pesticides to public health, wildlife and water pollution."—*Editor*